hoped that the rational part of the community will see its reasonableness, and will do their best to have it thoroughly carried out.

Similar measures have long been enforced in Berlin and other Continental cities, and have been followed by the most gratifying results in the diminution or suppression of the dreaded hydrophobia.

BOTANICAL RESULTS OF THE "CHALLENGER" EXPEDITION

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873-76 *under the Command of Capt. G. S. Nares, R.N., F.R.S., and Capt. F. T. Thomson, R.N.* Prepared under the Superintendence of the late Sir C. Wyville Thomson, F.R.S., &c., and now of John Murray, one of the Naturalists of the Expedition. Botany—Vol. I. By William Botting Hemsley, A.L.S. (Published by Order of Her Majesty's Government, 1885.)

THE botanical results of the voyage of the *Challenger* hitherto published have been confined to the reports of Mr. Moseley, sent home from time to time during the voyage, along with collections of plants made by him, to Kew, and published, along with lists of the species, in the *Journal* of the Linnean Society. In the volume before us we have the results of a more detailed working up of the material thus obtained so far as it belongs to insular floras. Mr. Hemsley, who is responsible for the book, brings to his task botanical experience which begets the liveliest confidence in the thoroughness and accuracy of the work, and the volume will certainly compare with any of those upon the zoological results of the voyage already published. It is necessary to emphasise the fact that Mr. Hemsley is the author of the book, for it is not patent on first inspection. The title-page, where one naturally looks for information upon the subject of authorship, tells that the volume is published under the superintendence of Mr. John Murray, who writes barely a page of preface, but it says nothing of Mr. Hemsley, the author of the rest of the book—over 900 pages—and it is only by turning up the table of contents that his connection with the book is found recorded. This may be consistent with uniformity in the appearance of the *Challenger* publications, but hardly, we think, with consideration for the author.

Although appearing amongst the scientific results of the *Challenger* voyage, Mr. Hemsley's work has a considerably wider basis than the botanical insular collections made during that voyage. From the rich stores of the herbaria at Kew and the British Museum he has sought out and made use of collections and records of observations of travellers, both old and recent, so far as they relate to islands from which Mr. Moseley procured specimens, and he is thus enabled to present an account of all that is known of the vegetation of these islands,—in some cases their complete flora. The book is, then, no mere descriptive synopsis of the botany of the *Challenger* Expedition. Its nature may be gathered from Mr. Hemsley's own description :—

"In the introductory notes on the vegetation of the various islands included in the reports on the botany of the Expedition are embodied tables showing the distribution of the genera and species of each island or group of islands. There are also observations on the composition, affinities, &c., of the different insular floras, together with references to the diverse agencies operating in the dispersal of plants, whilst numerous facts and suggestions bearing upon the same subject are scattered throughout the lists. Finally, the appendix to the third part of the botany is devoted to the record of evidence of the part played by oceanic currents and birds in the transport of seeds from place to place. The general introduction is not limited to a mere summary of the facts contained in the reports, and speculations thereon ; it has been so extended as to form an epitome of the botany of a large number of oceanic islands and of the Antarctic regions generally. The special characteristics of insular vegetation in various parts of the world are set forth and compared with continental vegetation ; and, as a whole, the work may perhaps serve as an indication to travellers of the nature and extent of the observations required for the advancement of this most interesting subject."

As to method the book is divided into four parts. The first is a "Report on the Present State of Knowledge of various Insular Floras," being an introduction to the botany of the *Challenger* Expedition. The second and third parts are Reports "On the Botany of the Bermudas and various other Islands of the Atlantic and Southern Oceans," namely, St. Paul's Rocks, Fernando Noronha, Ascension, St. Helena, South Trinidad, Tristan d'Acunha Group, and St. Paul and Amsterdam Islands, and the chain of islands from the Prince Edward Group to the Macdonald Group. The fourth part consists of a "Report on the Botany of Juan Fernandez with Masafuera, San Ambrosio, and San Felix, the South-Eastern Moluccas, and the Admiralty Islands," to which is added an Appendix "On the Dispersal of Plants by Oceanic Currents and Birds."

The scope of the volume is so comprehensive, and the subject is in touch with so many of the interesting problems connected with plant-distribution, that in this notice we must content ourselves with merely indicating some of the more prominent features that characterise the book. At the outset we may state that it abounds with interesting and new facts, and the analytical tables graphically representing various facts of distribution, compiled evidently with great care, are exceedingly striking, and bring out contrasts in a manner no amount of writing could effect.

The introductory part is really a series of essays upon various interesting subjects connected with phytogeography, which are mainly treated in their bearing on insular floras. An early chapter deals with the classification of islands in relation to the composition of their vegetation. Wallace's classification of oceanic and continental islands, whilst harmonising with the features of vegetation of many islands, is not adapted, Mr. Hemsley thinks, for exhibiting the floral peculiarities of islands generally. The Bermudas and Galapagos, for example, included in Wallace's oceanic group, cannot be fairly placed in the same category. He therefore proposes a classification which in effect, so far as it is applied in this volume, amounts to the subdividing of Wallace's oceanic group into ancient, more recent, and new sub-groups. Islands may be arranged, he says, for phytogeographic purposes, in three categories, according to their endemic element, namely:—(1) Those with "vegetation comprising a large endemic element, the nearest affinities of which are not always found in any one continent"; to this category belong St. Helena, Juan Fernandez, the Sandwich, Galapagos, and Seychelles Groups. (2) Those with "vegetation comprising a small, chiefly specific endemic element, the origin of which is easily traced"; here are included the Bermudas, Azores, Ascension, the islands in the southern part of the Indian Ocean, and the Admiralty Islands. (3) Those with a "vegetation comprising no endemic element" (which have become stocked with plants in very recent times); such are the Keeling and other coral islands in the Indian and Pacific Oceans. A statistical account of floras of several islands not treated of in detail in the subsequent reports is given to illustrate the feature characteristic of these several categories.

A very prominent place is given by Mr. Hemsley to the question of the "dispersal of plants by oceanic currents and by birds." In the appendix to Part III. there are descriptions of drift-seeds and seed-vessels, and of seeds and fruits from the crops of birds, collected by Mr. Moseley, Dr. Guppy, and others, to which is prefaced an historical *résumé* of the subject. We have in fact an epitome of all that has been written upon the subject up to the present time. The evidence Mr. Hemsley brings forward of the potency of these agencies in plant-dispersion is irresistible, and effectively overthrows the opinion so frequently expressed by Alphonse de Candolle—an opinion founded in great part upon the capacity of seeds to retain vitality when immersed in sea-water, as determined by experiment—that oceanic currents have played and play an unimportant part in plant-diffusion. The views of the two botanists are placed in striking contrast by a comparison of the list of species certainly or probably dispersed by ocean currents given by each: De Candolle's contains about two dozen, Hemsley's over 100. Mr. Hemsley guards himself against being supposed to regard the sea as the principal agent, or indeed as anything more than a subordinate agent in bringing about the present distribution of plants, "for it is manifest that the action of currents and birds of passage are insufficient to account for certain elements in the vegetation of many islands." But at the same time he goes so far as to maintain that the littoral flora owes its present characteristics to the fact that the seeds of the plants composing it are capable of withstanding long immersion in sea-water, and are thus suited for oceanic transport. That the present general diffusion of a large proportion of the plants inhabiting the tidal forests and sandy and muddy sea-shores of the tropics is in a great measure due to oceanic currents is, in his opinion, quite certain from the evidence; a view from which few, we imagine, will be inclined to dissent. In illustration of this subject he gives (taking a small selection of flowering-plants whose seeds are transported by oceanic currents and by birds) the following picture of the gradual invasion of an island by herbs, shrubs, and trees. "The seeds of many almost ubiquitous sand-binding grasses may be reckoned among those which are cast ashore in a vital condition, and we assume that these grasses are amongst the first flowering-plants to obtain a footing. Other herbaceous plants met with in the earliest stage of such an insular flora are *Portulaca*, *Sesuvium*, *Canavalia obtusifolia*, and *Ipomœa biloba* (*I. pes-capræ*); all of which seem to possess an unlimited power of colonisation. Moreover, they provide the conditions necessary for other plants to be able to establish themselves. Among the early shrubby occupants, *Suriana maritima*, *Pemphis acidula*, *Scævola Kœnigii*, and *Tournefortia argentea* are prominent, being found on the most remote islets of the Pacific and Indian Oceans within the tropical and sub-tropical zones. Where there are muddy shores, there the various mangroves (*Rhizophora*, *Bruguiera*, *Avicennia*, *Vitex*, &c.) take possession. Among the first real trees are *Heritiera littoralis*, *Hibiscus tiliaceus*, and *Barringtonia speciosa*, together with screw-pines. After this nucleus of a flora has been formed, it is comparatively easy for other arrivals to establish themselves; and every addition in a measure helps to provide the conditions for a still more varied vegetation." And he concludes:—"It may be safely assumed, therefore, that if oceanic currents and birds have not been the means of dispersing a large number of species of plants, and it is not certain that they have not, they are certainly the most important agents in stocking islands, for without their action the numerous remote coral islands, at least, would still be utterly devoid of phanerogamic vegetation, and consequently uninhabitable."

As a concrete illustration of the influence of these agencies in stocking islands, an analysis of the indigenous vegetation of the Bermudas is given, which shows that 45 species are chiefly littoral plants, the seeds having been probably conveyed to the island by oceanic currents; 38 are marsh plants, with small seeds, possibly conveyed to the island in mud adhering to birds, though many may have reached in vegetable drift; 13 are plants with more or less fleshy fruits, and probably were carried by frugivorous birds, leaving a very small number of species introduced, probably indirectly, by man.

In a chapter upon the Antarctic flora, and the origin of the vegetation of the islands of the South Indian Ocean, Mr. Hemsley subscribes to the view advanced by Sir Joseph Hooker, and maintained by others, that a former greater land connection in the southern hemisphere is necessary to account for the present distribution of the vegetation in this region, and that a northward migration of southern forms has taken place in the past, and has perhaps hardly ceased. He thinks a greater land connection than Wallace allows must have existed, though the continental extension demanded by Hutton is unnecessary. At the same time he admits that a land connection so great even as Wallace assumes, along with alternations of climate, removes many of the difficulties in the way of accounting for present distribution, and if Thiselton Dyer's hypothesis be accepted, that the northern hemisphere is the primary home whence a southward migration of the forms of vegetable life has taken place, he considers a sufficient explanation is obtained. But he dissents entirely from Thiselton Dyer's view, holding that "until more conclusive testimony is forthcoming of the former existence of *Proteaceæ*, *Eucalypti*, &c., in Europe, we cannot avoid the conviction that they originated in the south."

Mr. Hemsley points out that the absence of general structural peculiarities in insular plants, and the occurrence of their physiognomic features in many continental areas, adds to the difficulties of plant geographers. He shows that no order, no sub-order, not even a tribe, is endemic in the smaller oceanic islands, and that the very distinct genera that occur are not disproportionate. To the question, Do the flowers of endemic insular plants present any peculiarities of size, shape, or colour? we get an instructive answer in the tabulated analysis of the endemic plants of St. Helena. From it we learn that "the size of the flowers and flower-heads in this flora is on the whole rather above than below the average of those of their allies in other parts of the world. When we come to colour, however, the equality fails altogether, red being almost entirely wanting in the insular plants, and blue unknown." The absence of butterflies and the abundance of moths on the island is a significant concomitant circumstance, as Mr. Hemsley remarks. Particulars are not yet forthcoming from other islands to permit of like analysis, and Mr. Hemsley merely concludes that brilliantly-coloured flowers are rare in such islands.

Amongst the special features of insular floras discussed and illustrated by Mr. Hemsley in the introductory portion of the volume, is the preponderance of shrubby and arboreous Compositæ, and of woody plants generally. That islands "often possess trees and bushes belonging to orders which elsewhere include only herbaceous species" as Darwin stated, he shows, by tabulated evidence of the occurrence of arboreous or shrubby forms allied to insular ones upon continental areas, requires modification. To illustrate the difficult problem of the absence or rarity of large, almost ubiquitous, orders in oceanic islands, he selects Leguminosæ, Orchideæ (the table showing the absence of species or the number of species of Orchideæ in various islands is extremely interesting), and Gymnospermæ; and the concomitant rarity of insects is suggested as a probable explanation so far as the first two orders are concerned. We cannot further notice these and other fascinating subjects dealt with by Mr. Hemsley in the introduction, but must recommend botanists and all interested in the subject of plant-distribution to peruse the volume, where, in addition to the information imparted by Mr. Hemsley himself, they will find a serviceable bibliography of insular floras and an index of islands with the names of authors who have written about them.

In the introductory notes to the several floras in the second, third, and fourth parts of the book Mr. Hemsley manages to convey a vast deal of information. Accounts of the physical features, the history of the island, as well as analyses of the vegetation are given, and he finds room for illustrative extracts from the works of travellers who have visited the islands. Many interesting subjects crop up in these—for example, the question of the sandal-wood in Juan Fernandez; but space forbids our noticing them. It needs, however, little examination of this portion of the book to convince one of the genuine character of the work which has been put into the preparation of the floras. The synonymy, the distribution, the critical notes, and the general information regarding each species, all testify to a conscientious search after completeness and accuracy, the result being a thoroughly trustworthy record of what is at present known regarding them. One point we may criticise unfavourably. We notice Mr. Hemsley has adopted the system of writing all specific names with a commencing small letter. This, though a prevailing custom with zoologists, is an innovation in botanical description in this country, and without discussing methods of nomenclature, which would be beside our purpose here, we would simply say that we do not agree with Mr. Hemsley in admiring it.

We have only been able to touch upon a few points in this excellent volume, sufficient, we hope, to indicate its importance. Problems of plant-distribution meet us frequently throughout the volume, and Mr. Hemsley's work is a most important contribution towards their solution. Of especial value is his treatment of the subject of the sea and birds as factors in distribution. A somewhat disjointed character in the book and frequent repetition are defects which are perhaps inseparable from the method of its preparation. For inequalities the author apologises, and the merit of the book as a whole fully atones for them. Mr. Hemsley's deservedly high reputation as a systematic botanist, confirmed by his "Botany of Central America," now approaching completion, is still further enhanced by this his most recent work.

We may add that the volume is illustrated by many excellent plates, chiefly drawn by Miss Smith.

Besides bearing witness to the good fortune which placed the making of botanical collections during the voyage of the *Challenger* in the hands of so able a naturalist as Mr. Moseley, the volume testifies in a very emphatic manner to the inestimable value of our national herbaria, especially that at Kew. Collections of plants, small and incomplete in themselves, are there accumulated ready for use when occasion requires, forming the material from which such volumes as this we notice may be constructed. We cordially join Mr. Hemsley in his hope that his work may direct attention to the nature and extent of the observations required from travellers for the advancement of our knowledge of the subject of plant-distribution, and we may conclude with one other aspiration. There is at present no authoritative book in our language on the subject of botanical geography, and too many of the phytogeographical works published nowadays are purely statistical compilations. Is it, then, too much to expect from the pioneer in the philosophical treatment of plant-distribution, Sir Joseph Hooker, whose name is in so special a manner associated with the subject of insular floras, a comprehensive work on botanical geography such as he alone could write? We hope not.

HALSTED'S "ELEMENTS OF GEOMETRY"

The Elements of Geometry. By G. Bruce Halsted. (New York: John Wiley and Sons, 1885.)

MR. HALSTED is already favourably known to English mathematicians by an excellent "Elementary Treatise on Mensuration" (published in the summer of 1881), and by one or two carefully compiled bibliographies in the *American Journal of Mathematics.* The faithful chronicler records of Tom Tulliver that he called his Manual of Geometry "the exasperating Euclid," a title richly deserved if his desire to be excused the "doing" of it were really based upon the reason he assigned, viz. "It brings on the toothache, I think." Now we have not an annotated copy of the "Mill